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FURTHER NOTES ON CLADONIAS. V.

Cladonia gracilis.

BRUCE FINK.

As promised in the last paper of this series we will consider in the present paper *Cladonia gracilis*. The species has been greatly abused in being subjected to "the splitting process" by European workers, but Wainio has succeeded in bringing order out of the chaos of names, and one who has learned to use his Monograph finds little trouble in applying his revision to our American forms of the species. The present writer thought years ago that *Cladonia gracilis* was the most difficult of all our Cladonias, but further acquaintance with *Cladonia fimbriata* gives that species first place as a difficult one. And it now appears plain enough that much of the difficulty with *Cladonia gracilis* was really due to an attempt to follow Tuckerman, who included *Cladonia verticillata*, disposed of in our last paper, with the present species. Then, too, *Cladonia gracilis symphy-carpia* Tuck. has been parceled out by Wainio to *Cladonia subcariosa* and *Cladonia cariosa*. Tuckerman gave his variety this description, "cups obsolete from the first, apothecia confluent," and this was wholly inadequate so that no one could conceive what he meant without seeing the specimens. This Wainio has done and has no doubt placed them where they belong. Indeed, it is apparent enough now, after Wainio has done the work, that Tuckerman's brief diagnosis would apply to a form of *Cladonia cariosa* or *Cladonia subcariosa* as well as to one of the species treated in this paper.

Is it any wonder that we could never understand *Cladonia gracilis* while attempting to follow Tuckerman in placing forms of at least four species here? And, though our forms of *Cladonia cariosa* and closely related species should not be confused with *Cladonia gracilis*, we will consider these plants in the next paper of this series and attempt to remove whatever confusion exists by as good descriptions and figures as we can produce.

In treating the present species, the writer considers himself exceedingly fortunate in being able to see the specimens collected by Mr. G. K. Merrill, on Mount Washington, N. H., during the last summer, and in being able to present figures from photographs taken by Mr. Merrill, from specimens collected in this best known American collecting ground for the species. Indeed, but for the keen-eyed work of this collector, we should have to present figures made partly from European specimens, and we are under great obligations for both the specimens and the photographs.

Before passing to the descriptions of the various forms of the species, it should be stated that the eastern forms are as a rule longer and more slen-

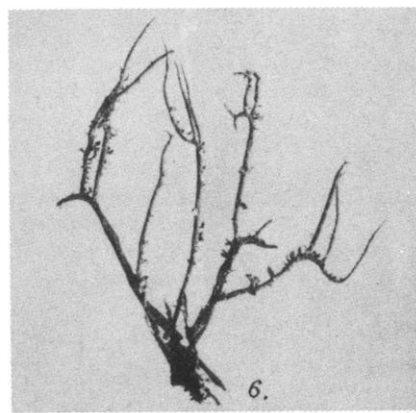
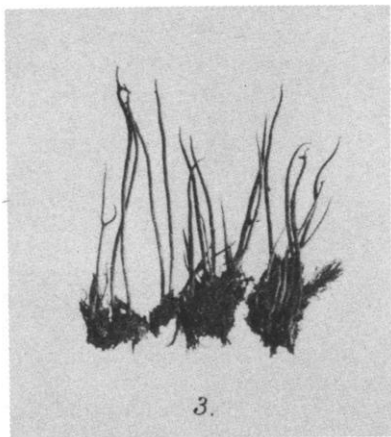
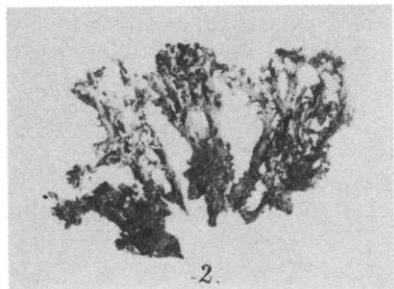
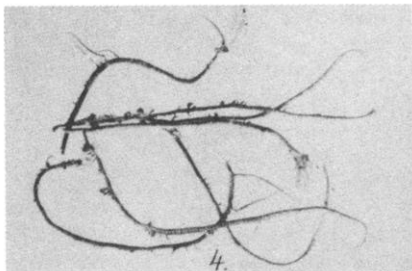
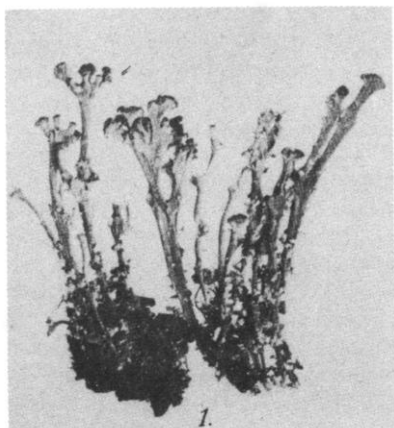


PLATE IV. Fig. 1. *Cladonia gracilis* var. *dilacerata*. Fig. 2. Var. *anthocephala*. Fig. 3. Var. *chordalis*. Fig. 4. Var. *aspera*. Fig. 5. Var. *elongata*. Fig. 6. Var. *laontera*. All slightly reduced.

der than the western. This appears in comparing the figure of *Cladonia gracilis dilacerata* presented with this paper and collected by Mr. Merrill in Knox County, Maine, with that of *Cladonia gracilis dilatata* figured in the last paper of this series, and collected on Isle Royale, in Lake Superior, by Mr. Edward L. Harper. And it is again shown in comparing the form *anthocephala*, collected by the writer in Minnesota, with any of the other figures presented in this paper. Likewise, there is recorded in this paper a specimen of *Cladonia gracilis elongata* from Montana, collected by L. H. Pammel, and this also is more inclined to be shorter and runs into ordinary forms of the species. Then to the eastward we get other elongated varieties than *elongata*, as recorded below, and these elongated forms seem to predominate, at least on Mount Washington.

Also, Tuckerman states that the plants are paler in lower altitudes as in lower portions of Maine, Massachusetts and California. Our forms from Minnesota are paler than those collected recently in New England by Merrill, but it appears also that forms of *Cladonia amaurocraea*, quite elongated and with cups, have been frequently placed under *Cladonia gracilis*. Such forms are thus disposed of in the Tuckerman herbarium at Harvard, and a recent specimen collected by W. C. Farlow, on Mount Washington, and named *Cladonia gracilis*, is surely the elongated *Cladonia amaurocraea* and considerably paler than forms of the present species. Also *Cladonia gracilis chordalis*, "Lichenes Boreali-Americani," no. 272, seems to be this same *Cladonia amaurocraea*.

CLADONIA GRACILIS (L.) Willd. Fl. Berol. 363. 1787.

Primary thallus usually persistent, composed of irregularly lacinate or crenate, somewhat flat, involute or convolute, ascending, clustered or scattered squamules, which are somewhat incrassate and middling sized, 2-5 mm. long and nearly as wide, sea-green varying to olivaceous above, and white below or brownish toward the base. Podetia arising from the surface of the squamules, 10-75 mm. long and .3-5.5 mm. in diameter, cylindrical and cupless, or more or less narrowly trumpet-shaped and scyphiform, commonly in larger or smaller clusters, erect or ascending, the cortex subcontinuous or composed of contiguous or scattered areoles, rarely squamulose, the decorticate portions between the areoles sometimes granulate sorediate, variously sea-green, olivaceous, or even reddish-brown, the decorticate portions white, sometimes dying below and the dead portions becoming dark colored, simple or more or less branched, the sides sometimes more or less rimose or perforate. Cups .75-6 mm. in diameter, abruptly or gradually dilated, regular or irregular, shallow or deep, the margins dentate or proliferate (rarely proliferate from the centre?), the ranks from one to five, the lowest rank from 10-70 mm. long, and when four or five ranks the whole podetium longer than stated above. Apothecia medium sized, 1-4.5 mm. in diameter, usually lobate-conglomerate and sometimes perforate, commonly borne on short pedicels, which frequently arise singly or in clusters from the margins of the cups, thinly margined or more commonly convex and immarginate, pale or darker brown. Hypothecium pale. Hymenium pale below and brownish

above. Paraphyses rarely branched, thickened and brownish toward the apex. Asci cylindrico-clavate.

Widely distributed over North America in one form or another, and specimens not yet assigned to any of the varieties have been seen by me from Massachusetts, Mount Washington, Ontario, Iowa, Minnesota, Illinois, and Alaska. This indicated a wide distribution throughout northern North America, corresponding thus with the views of Tuckerman and Wainio. No specimens of the species are known to the writer from the southern half of the United States. The plant is known in all of the grand divisions.

CLADONIA GRACILIS DILATATA (Hoffm.) Wainio Mon. Clad. Univ. 2:87. 1894.

Podetia frequently stouter, 1–5 mm. in diameter, scarcely exceeding 50 mm. in length and usually much shorter, destitute of squamules or rarely squamulose toward the base, neither granulose-sorediate nor decorticate, cortex continuous or sometimes areolate, cups quite dilated and subregular, the ranks rather short.

Tuckerman's var. *hybrida* Schaer. is this and the next as he says, "podetia often beset with squamules." He states that his variety is found wherever var. *elongata* occurs, which is true and more. For the present variety and the next occurs at lower altitudes than *elongata* to the south, and also farther south. I have examined material of my own collecting of the present variety from Iowa, Minnesota and Massachusetts, and by others as follows: New York (E. A. Burt), White Mountains (H. Willey), Montana (R. S. Williams), Columbia River and Nova Scotia (J. Macoun), Newfoundland (A. C. Waghorne), and Alaska (Kincaid?). Macoun reports var. *hybrida* as very common throughout British America, and his specimens are no doubt nearly all this common variety, rather than the next much rarer form. Miss Clara E. Cummings also reports the present variety from Alaska. Reported from all the grand divisions. (See last paper of this series for figure of the variety, with squamules at base and near the next below).

CLADONIA GRACILIS DILACERATA Flk. Clad. Comm. 37. 1828.

Differing from the last in that the podetia are always squamulose elsewhere as well as at the base, and often conspicuously so at the top of the podetia among the apothecia. The cups also are rather more inclined to irregular forms than in the last. *Cladonia gracilis anthocephala* Flk. Clad. Comm. 37. 1828, Wainio considers a form of the present with numerous squamules at the top of the podetia. Plate IV. Figs. 1 and 2.

Wainio credits this variety from Greenland and states that Tuck. Lich. Amer. Exsic. no. 27 is this in part. He has determined the ordinary form and the one with squamules numerous upward, from northern Minnesota. The variety is evidently rare in the United States, and the writer has seen it only from Minnesota, of his own collecting, and from Maine (G. K. Merrill) and Yellowstone Park (Aven Nelson). Much rarer and only known, outside North America, in Europe.

CLADONIA GRACILIS CHORDALIS (Flk.) Schaer. Lich. Helv. Spic. 32. 1823.

Podetia quite slender, subulate, or tubaeform and scyphiform, destitute

of squamules or rarely and very sparsely squamulose, neither granulose nor decorticate, cortex continuous or areolate, elongated, 30-140 mm. long and only about .1-2 mm. in diameter, sparingly branched, and the branches at least partly subulate, the lowest rank long. Cups narrow, only about 2-5 mm. in diameter, regular, or sometimes oblique or irregular, and often radiate or proliferate. Plate IV. Fig. 3.

Wainio credits specimens from Great Bear Lake and Greenland, and Tuckerman barely mentions the variety under *Cladonia gracilis elongata* as a form of that variety. Miss Cummings found the variety to be common in the material examined from Alaska. I have determined it from Newfoundland (A. C. Waghorne) and from Mount Washington (G. K. Merrill). Also from Mt. Ranier region, Washington, 1,500 ft. (T. C. Frye). This variety is known in all of the grand divisions.

CLADONIA GRACILIS ASPERA Flk. Clad. Comm. 40. 1828.

Podetia and cups much as in the last, but the podetia usually shorter, never exceeding 100 mm. and always squamulose, also rather more slender as a whole, and rarely branching more freely. Plate IV. Fig. 4.

Wainio reports this variety from Miquelon Island, and I have determined it from Mount Washington for G. K. Merrill. Nothing more is known of North American distribution, but the plant is recognized in Europe, Asia and Africa.

The worth of the variety may be questioned as it seems to stand in nearly the same relation to var. *chordalis* as the form *laontera* noted below does to *Cladonia gracilis elongata*. However, there are other slight differences than the presence or absence of squamules, at least in some instances, and we let the variety stand rather than depart from Wainio's view without sufficient study. Varieties *chordalis* and *aspera* stand in somewhat the same relationship to each other as varieties *dilatata* and *dilacerata*, but better acquaintance has emphasized the difference between the last two.

CLADONIA GRACILIS ELONGATA (Jacq.) Flk. Clad. Comm. 38. 1828.

Podetia not surpassing the extreme length given for var. *chordalis*, but on the whole longer, averaging about 75 mm. long and *chordalis* only 50 mm., likewise plainly stouter, 1-5 mm. in diameter, branching rather less frequent than in the last two varieties, but sometimes quite freely branched, destitute of squamules (except in the little-known form *laontera*), cortex continuous or areolate, subulate or scyphiform. Cups also as in last two varieties, except that they are larger, 2-6 mm. in diameter, or rarely even 12 mm. Plate IV. Fig. 5.

Wainio credits the plant from Greenland, Labrador, Kotzebue's Sound, Port Clarence, Vancouver Island, British America, White Mountains and western United States. John Macoun lists it from all parts of British America, and Miss Cummings reports it as common in Alaska. I have examined it from Mount Washington (G. K. Merrill, 4,000-6,000 ft.), Knox County, Maine (also by Merrill), the Adirondack Mountains (Carolyn W. Harris) and from Warm Springs in Montana at 5,000 ft. alt. (L. H. Pammel). The squamulose form, *Cladonia gracilis laontera* (Del.) Arn. Rehm. Clad

Exsic. no. 261, Plate IV. Fig. 6. was also sent me from Mount Washington by G. K. Merrill. This form is little known even in Europe, and is not regarded worthy of varietal rank, Tuckerman doubtless knew of it, for he speaks of the squamules sometimes occurring in the present variety. We figure the form *laontera* as well as the usual expression of the variety. The variety is known in all the grand divisions except Australia, commonly in mountains.

The various forms of *Cladonia gracilis* commonly occur on earth, on horizontal rocks covered with a small amount of humus, or on rotting wood. The plants are usually found in forests, preferring shade, and are often among mosses. The last variety descends to the tundras in northern regions and there often occurs in sunny and windy places. Grinnell, Iowa.

PHAENOLOGICAL OBSERVATIONS ON MOSSES.

H. WILHELM ARNELL.

In the BRYOLOGIST there appeared, in the year 1904, p. 35-36, a note on "The Fruiting Season of the Hair-cap Moss," by Phebe M. Towle and Anna E. Gilbert, that interested me much as it touched upon a subject which I myself have studied. A rather long time ago I studied the seasons of blooming and fruiting of the Scandinavian mosses (*musci veri*). The results of my researches were summed up in a paper, "De Scandinaviska Löfmosornas Kalendarium (Upsala Universitets Arsbkrift, 1875) in which the seasons of blooming and fruiting of all Scandinavian mosses known at that time were indicated as accurately as the material that was accessible permitted me to solve these questions. Since that time there has, as far as I know, nothing been published on the phaenological relations of the mosses till the paper of A. Grimme, "Ueber die Blüthezeit Deutscher Laubmoose und die Entwicklung ihrer Sporogone" appeared in Hedwigia, 1903.

I will now tell the results to which I have come with regard to the Hair-cap mosses. The species of *Polytrichum*, I found phaenologically to constitute two different groups. The species belonging to *Ymnitrichum* (Neck) Lindb., namely *P. urnigerum*, *P. nanum* and *P. subrotundum*, bloom at an early season at Upsala, in May or the first week of June, and the lids of the sporogones are therefore cast in the winter or early spring, at Upsala in December to April. These mosses thus require less than a year or seven to ten months for the development of their sporophytes. The majority of the Scandinavian *Polytricha*, the sections *Pterygodon* Lindb. and *Euleiodon* Lindb., bloom early in the summer, at Upsala in June and July, while the sporogones become ripe in July or the first days of August. These species require more than a year or about thirteen months for the development of their fruits. The two species of *Polytrichum*, *P. juniperinum* and *P. commune*, observed by the Misses Towle and Gilbert, both belong to the latter group of Hair-cap mosses. A comparison of their dates with mine shows a rather great difference, as according to the observations in Vermont, these mosses bloom in April, and the maturing of the spores takes place in August of the